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NOTES

INTERNATIONAL PRICE INDEXES*

The *Federal Reserve Bulletin* for May contains a discussion of the method to be used in the construction of a series of international price index numbers by the Division of Analysis and Research of the Federal Reserve Board. A new index number for the United States, which is the first of the series, also is published in that number of the *Bulletin*. Index numbers for England, France, Italy, and Japan are in process of construction. The first two will probably be published in the autumn.

METHOD OF CONSTRUCTION

Each index number is to consist of approximately ninety different wholesale price quotations, the commodities to be classified (1) according to their stage of manufacture, as raw materials, producers' goods, and consumers' goods, and (2) according to their derivation and use, as goods produced, imported, exported, and consumed. The year 1913 is used as the base year. No attempt has been made to cover the war period. The same method of weighting will be used in the case of each index number. Prices of goods produced will be weighted by the quantity produced, prices of goods imported by the quantity imported, etc. All of the indexes are being planned and the computations made in this country in order to insure uniformity of method. Actual prices are collected abroad by consular agents and cabled to the Federal Reserve Board the first of each month. The index numbers will be published monthly for the preceding month.

The plan outlined above was developed after considerable study of the problem, both as to the ends to be gained in making a series of foreign index numbers, and the best methods for reaching these ends. The aims are three: first, to obtain better and more comparable indexes of the general wholesale price levels of the leading foreign industrial countries; second, to increase our information regarding the movement of prices of goods entering into foreign trade; and third, to classify the material in such a way as to throw as much light as possible upon current business conditions abroad.

A study of the indexes currently published abroad showed that in most cases they consisted of the prices of not more than forty-five commodities, most of which were raw materials or in a very early stage of manufacture, that all of the commodities quoted were given equal representation in the index numbers regardless of their importance in the economic life of the countries concerned, and that in some cases import and export valuations were used in computing the numbers instead of wholesale market quotations. The year or series of years used as the base from which to measure price changes differed in every case, so that it was necessary to recompute the numbers to make them comparable.

Obviously such indexes were not satisfactory either for showing accurately

*The Division is indebted to Walter W. Stewart of Amherst College for making constructive suggestions regarding the organization and weighting of the index numbers.

the general price levels of individual countries or for making comparisons between countries. Improvement could be made in the following respects at least:

- (1) By including a larger number of quotations.
- (2) By including not only raw materials but semi-manufactured, and manufactured commodities in them.
- (3) By weighting the commodities according to their industrial importance.
- (4) By using wholesale market quotations collected from reliable sources.
- (5) By using the same base year for all countries.

Scientific work done in the field of international price comparisons had emphasized the fact that for comparative purposes it was important to have all the indexes approximately the same size and based upon the prices of the same commodities. Experimentation showed that the first point was essential, *i. e.*, that the index numbers should all be of approximately the same size. Otherwise, an unnecessary element of dissimilarity was allowed to influence the comparisons. The second point, namely, that the same or similar commodities form the basis of all indexes, did not appear equally valid for the reason that all countries differ economically one from another, and no single list of commodities represents them all equally well. Carefully matched commodities are essential for the purpose of comparing actual prices from country to country; representative commodities, on the other hand, are preferable as a basis for index numbers.

Ninety quotations (the number allowed for each of the new indexes) provides representation for all of the leading commodities of a country, is small enough to be a fairly sensitive barometer of price changes, and is not unnecessarily expensive. Such a number is big enough to prevent one commodity, or a small group of commodities, from influencing the final index unduly. It also allows a fair representation to commodities in different stages of manufacture and of different derivation and use. In respect to size, it marks a considerable improvement over existing index numbers.

A year ago, when the international price indexes were first planned, it was thought unlikely that sufficient foreign statistical material could be obtained in this country to furnish a satisfactory system of weighting for the proposed index numbers. The desirability of weighting the commodities according to their importance in the different countries was generally conceded. Fortunately, however, foreign statistics for 1913 were available in larger quantities than was anticipated, and as a result the method of weighting has become one of the most important features of the new index numbers.

In order to carry out the second aim mentioned above, namely, that of making index numbers which would facilitate the study of prices in their relation to foreign trade, it was decided to classify the commodities as domestic goods, imported goods, and exported goods. The method of weighting adopted suits this purpose excellently, as the prices of domestic goods are weighted by the quantity of goods produced in 1913, the prices of imported goods by the quantity imported, the prices of exported goods similarly by the quantity exported, and the prices of goods consumed by the quantity consumed in that year. The general index is made by putting together the weighted prices of domestic goods and imported goods. In other words, the method of weight-

ing the all commodities index is that of production plus imports in 1913. The system of weighting may be expressed in the equation, goods produced + goods imported = goods exported + goods consumed.

An index number can be very quickly constructed and easily carried on if weighted in this fashion. Monthly index numbers are obtained by using the following formula:

Let p_0 = the price of wool in any month

p_1 = the price of hides in the same month

p_2 = the price of cotton in the same month

etc. for other commodities in the index

Let q_0 = the quantity of wool produced in 1913

q_1 = the quantity of hides produced in 1913

q_2 = the quantity of cotton produced in 1913

etc. for other commodities in the index

Let i_0 = the quantity of wool imported in 1913

i_1 = the quantity of hides imported in 1913

i_2 = the quantity of cotton imported in 1913, etc.

Let e_0 = the quantity of wool exported in 1913

e_1 = the quantity of hides exported in 1913

e_2 = the quantity of cotton exported in 1913, etc.

Let c_0 = the quantity of wool consumed in 1913

c_1 = the quantity of hides consumed in 1913

c_2 = the quantity of cotton consumed in 1913, etc.

Then $\Sigma P Q$ = the sum of the prices in the chosen month of goods produced $\times$ the amounts produced

$\Sigma P I$ = the sum of the prices in the chosen month of goods imported $\times$ the amounts imported

$\Sigma P E$ = the sum of the prices in the chosen month of goods exported $\times$ the amounts exported

$\Sigma P C$ = the sum of the prices in the chosen month of goods consumed $\times$ the amounts consumed

Or $\Sigma P Q + \Sigma P I = \Sigma P E + \Sigma P C$ and the index numbers may be obtained by converting the money aggregates on both sides of the equation into relative numbers on the 1913 base.

The import and export classification is useful not only as showing the trend of prices in these two groups of goods, and thus throwing light on the relationship between foreign exchange, international trade, and prices, but it may be used also to correct the price factor in foreign trade statistics. The Federal Reserve Board has already begun to use the index numbers for the United States in this way, publishing for the first time in the *Bulletin* for July, 1920, a monthly index of the foreign trade of the United States based upon the trade in the commodities used in the export and import price indexes.

Classification of commodities according to stage of manufacture was made in order to facilitate the study of business conditions abroad, and to show the variations in the level of prices of raw materials, producers' and consumers' goods. This method of classification will probably be of more interest to the student of economic conditions than to the business man. For one reason, the significance of the variations in the prices of raw materials, producers' and consumers' goods,

and the meaning of the latter two terms are not generally understood. For the purpose of distinguishing between demand for goods for personal and family consumption and industrial demand either for equipment or raw materials, however, this classification is essential.

THE AMERICAN INDEX NUMBER

A demonstration of the type of information to be obtained from the new foreign index numbers is furnished by the American numbers published below:

AVERAGE PRICES 1913=100

Date	Goods Pro- duced (72 Quota- tions)	Im- ported (18 Quota- tions)	Ex- ported (39 Quota- tions)	Con- sumed (88 Quota- tions)	Raw Mate- rials (39 Quota- tions)	Pro- ducers' Goods (31 Quota- tions)	Con- sumers' Goods (20 Quota- tions)	All (90 Quota- tions)
1913								
January	100	105	100	100	99	105	99	100
February	100	104	100	101	99	105	99	100
March	100	103	99	101	100	105	99	101
April	101	101	99	101	101	103	99	101
May	100	100	99	100	100	102	99	100
June	100	99	100	100	100	101	101	100
July	100	99	99	100	98	101	102	100
August	100	101	99	101	101	100	101	101
September	101	100	102	101	102	98	101	101
October	101	98	103	100	102	96	101	100
November	99	98	102	98	100	95	101	99
December	98	93	99	97	98	91	99	97
1919								
January	197	168	200	195	195	193	196	195
February	191	168	192	190	190	191	188	189
March	193	163	194	191	196	185	188	191
April	198	165	194	196	201	181	197	196
May	204	172	211	201	209	184	202	202
June	204	180	214	202	208	192	202	203
July	214	176	224	211	217	200	211	211
August	221	174	219	218	217	206	224	218
September	215	170	212	211	211	203	216	212
October	215	174	226	212	213	207	214	211
November	222	179	242	217	220	213	219	219
December	231	205	249	225	223	223	225	226
1920								
January	244	212	255	240	245	236	240	242
February	244	216	252	242	242	247	240	242
March	250	218	256	247	246	263	241	248
April	265	242	264	263	263	274	257	263
May	266	246	262	264	263	274	261	264
June	261	226	256	258	258	265	256	258
July	255	204	248	251	250	251	254	251

Interesting factors in the general movement of wholesale prices in the United States since the armistice have been so frequently discussed that it is not necessary to go into the subject here. Although the Federal Reserve Board all commodities index runs considerably lower than that of the Bureau of Labor Statistics, the fluctuations in the two numbers are in substantial agreement. For some time past, the Federal Reserve Board has classified the commodities used in the index number of the Bureau of Labor Statistics into these three groups and has commented on the differences in their price fluctuations from time to time. As in the case of the all commodities index, the new numbers fluctuate in sub-

stantial agreement with those of the Bureau of Labor Statistics, but the percentages are likely to run lower. This is especially true in the case of consumers' goods. Why this difference in price levels exists requires a more detailed comparison of the two index numbers than we have as yet been able to make.

Although much has been written about prices recently, comparatively little attention has been given to the difference in the fluctuation of prices of domestic goods as compared with imported, or of imported as compared with exported. In this field the new index makes a contribution to the study of American prices. Since the period covered by these indexes amounts to only eighteen months (not including the base year), no definite conclusions can be reached regarding the significance of the fluctuations. It is too soon to attempt to correlate them with foreign trade movements, fluctuations in foreign exchange, or volume of production. A brief summary can be given, nevertheless, of the outstanding features of the three curves during the period covered.

Eighteen quotations are included in the index of prices of imports, thirty-nine in that of exports. It is somewhat unfortunate that the import index is not larger, but in view of the fact that the value of imports in 1913 was only about three-fourths as great as that of exports and far less important as compared with domestic production, larger representations could not be given to imported goods. Sugar, coffee, tea, hides and skins, wool, silk, cotton, rubber, nitrate of soda, tin, lumber, and several less important commodities make up the index, and their combined value in 1913 was 41 per cent of the total value of imports in that year.

Fifty-six per cent of the value of our exports in 1913 is represented in the commodities included in the index of prices of exported goods. These include our leading cereal crops, tobacco, cotton, copper, coal, pig iron and steel products, lumber, oil products, pork products, leather and shoes, cotton cloth, coffee, and other goods of somewhat less importance for export.

Prices of seventy-two commodities form the index of goods produced. Thirty of these are raw materials. Farm products provided something over half the total value of the group in 1913, products of mines and forests making up the rest. Twenty-four of the seventy-two commodities in the index are producers' goods, a little over 50 per cent of whose value in 1913 was provided by equipment materials, the rest being made up of such goods as yarns, leather, semi-finished foods, etc. Of the eighteen consumers' goods in the index, twelve are foods, and the rest materials used for clothing and lighting.

PRICES OF IMPORTS

January, 1919, to June, 1920, divides itself into three parts as far as import prices are concerned. The first period, lasting from January to September, 1919, was marked by a downward movement from January to March, a rise between March and June, followed by another reaction which left prices in September at approximately the same point as in January. Between September, 1919, and May, 1920, import prices steadily advanced, the increase amounting to as much, in terms of 1913 prices, as during the whole period of the war. The

index number stood at 170 in September and at 246 in May; in other words, prices of this class of goods increased about 45 per cent. May, 1920, marks another turning point, as prices in June showed a twenty point drop from those of May. In July there was a further decline of 22 points.

Falling prices from January to March, 1919, are easily accounted for by the industrial depression following the signing of the armistice. The revival during the next few months, however, was not so great as the revival in domestic and export prices, and the steady drop in import prices between June and September was of longer duration than was the case with domestic goods. This period is difficult to account for, as imports during the same time were rapidly mounting, showing that our demand upon foreign markets was on the increase. Certain important commodities continued controlled in price, however, and the demand for at least one of our leading imports, nitrate of soda, declined.

The phenomenal rise in prices between September and May was caused by our heavy demand for sugar, silk, hides, wool, etc., and the accompanying speculation in these commodities. Release of sugar from price control was another important factor in the situation. By May, 1920, however, there was no longer a market for several of these commodities, notably silk, hides, and wool, although sugar continued to advance; and by June practically every commodity which we import in quantity, including sugar, had declined in price.

A comparison between the prices of imported and domestic goods during the same period shows that imported goods were 68 per cent dearer in January, 1919, than in 1913. In the same month the prices of domestic goods were 97 per cent higher than in 1913. In other words, in January, 1919, the index number for imports was 17 per cent lower than that for domestic goods. By May, 1920, imported goods had advanced so rapidly that they were only 7 per cent less than domestic goods, but by July the old disparity in prices of the two groups had been re-established, the index number for imported goods being 25 per cent less than for domestic.

Why imported goods were and have continued considerably cheaper than domestic goods is probably to be explained by the fact that most of the materials in the index are obtained from markets where prices did not advance during the war at the same rate as in the United States or in Europe. Argentina furnishes us with wool and hides; Brazil with coffee and rubber; Chile with nitrate of soda; India with burlap; and other portions of the Far East with silk, tea, and tin; Australia with wool; the West Indies with sugar; and Canada with lumber. With the exception of Japan and Canada, probably none of these countries experienced such price increases as the United States between 1914 and 1919. In the case of rubber and coffee, conditions peculiar to the industries kept prices low during the war. New rubber plantations had just reached the productive period when war broke out, seriously curtailing European demand. Production could not be adjusted to the new conditions, and prices remained low. Inability to adapt production of coffee to war conditions kept prices of this commodity below pre-war levels. Price control, American and foreign, may have been more effective in the case of our imports than of our domestic goods, but as no studies have been made of this subject, it is impossible to be certain of it.

PRICES OF EXPORTS

Export prices during the past eighteen months cannot be broken up into periods as neatly as import prices. After the depression of early 1919, they advanced rapidly until July, when a break came, the prices of cotton, wheat, corn, and other food products declining. From September until January prices rose even more rapidly than in the preceding spring, but in February a slight decline came again, this time in approximately the same commodities as during the summer before. Prices advanced again in March and April, but since then have been slowly falling.

Prices of export goods have been relatively higher than the average of domestic goods and the general price level most of the time between January, 1919, and June, 1920, although this has not always been the case. At the present time domestic goods and the general price level are relatively higher than exported goods. Although fluctuations in prices of export goods have usually preceded those of domestic goods as a whole, no general conclusion can be reached because of the shortness of the period and the peculiarities of trade during that time. As was mentioned above, the total rise in export prices between January, 1919, and May, 1920, was much less great than was the case with imported goods. The level of prices, as compared with 1913, was, however, both in January, 1919, and in June, 1920, very considerably higher than that of imported goods.

European and American war demand caused the prices of our export goods, which are some of our leading commodities for home consumption as well, to rise at a faster rate than imports. Prices of these and other important domestic goods had a far greater effect upon our general price level than prices of imports, as is shown by the similarity in the index numbers of goods produced and all commodities, and the dissimilarity between the latter and the index of imported goods.

DIFFICULTY OF GETTING MATERIAL

Comparatively little difficulty was encountered in the construction of the American index number, as a great many prices have been collected by the Bureau of Labor Statistics and the Price Section of the War Industries Board, and as the latter organization has published considerable material regarding production and trade in individual commodities. With the foreign countries the situation is quite different. In the case of England and France a fairly large amount of material of a price and trade nature has been obtained. Even so, it has been necessary to apply to the foreign consuls for additional information. Price statistics and production estimates for highly fabricated commodities have had to be obtained direct from the industries concerned. Material available here regarding England and France is legion as compared with that for Italy. Although there is not much original Japanese price material here, official statistics showing the comparative importance of different industries and a good deal of expert advice regarding commodities can be obtained. On the whole, the construction of index numbers seems an entirely feasible undertaking for the countries so far studied, and probably will be in the case of Germany, Sweden, and Spain as well. It is, however, a tedious matter and will probably require a long time for completion.

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